

October 29, 1998

## **CRUISE RESULTS**

CHARTERED VESSELS R/V *DOMINATOR* (CRUISE 98-1)  
AND F/V *VESTERAALEN* (CRUISE 98-2)  
1998 WEST COAST TRIENNIAL GROUND FISH ASSESSMENT SURVEY  
JUNE 1 - AUGUST 9, 1998

The Resource and Assessment Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) recently completed the eighth in a series of triennial comprehensive bottom trawl surveys of West Coast continental shelf groundfish resources. This report summarizes the preliminary results of the survey.

## **Itinerary**

The survey was conducted aboard the chartered commercial trawlers *Vesteraalen* and *Dominator* from June 1 through August 9 (Table 1). The vessels worked northward from Pt. Conception, California, to central Vancouver Island (Nootka Sound), British Columbia, Canada (34°30'-49°30' N lat.), sampling predetermined stations at depths between 55 and 500 meters (Figure 1).

## **OBJECTIVES**

The triennial groundfish surveys are designed to describe and monitor the distribution, abundance, and population biology parameters of a variety of groundfish stocks off the U.S. Pacific coast and a small portion of the southernmost Canadian coast. Previous surveys in this series were conducted in 1977, 1980, 1983, 1986, 1989, 1992, and 1995. The objectives of the triennial survey series are:

1. to describe and assess the demersal component of the Pacific hake (*Merluccius productus*, also known as Pacific whiting) resource;
2. to describe and assess the shallow component of the sablefish (*Anoplopoma fimbria*) resource, specifically those 1.5 years old;
3. to monitor the abundance, distribution, and biological characteristics of principal rockfish (*Sebastes* spp.) species, including those inhabiting the upper continental slope;
4. to monitor the status of other important groundfish stocks;
5. to determine the biological population characteristics of key groundfish species (e.g. size composition, age composition, size at maturity, length-weight relationships, and trophic interrelationships);
6. to collect samples from a variety of species for biological studies that will be conducted by scientists at various fishery agencies and academic institutions; and
7. to collect sea temperature profiles and other oceanographic data.

#### VESSELS AND GEAR

Both chartered trawlers are 38 m long and powered by single main engines. The *Vesteraalen's* engine develops 1,710 continuous horsepower and the *Dominator's* engine develops 1,900 continuous horsepower. Each vessel was staffed by an experienced skipper, a four-member fishing crew, and six scientists.

The RACE Division provides standardized fishing gear for all of its surveys and both vessels used standardized polyethylene Noreastern high opening bottom trawls equipped with bobbin roller gear. Gear specifications include: a 27.2 m headrope with twenty-one 30 cm floats, and a 24.3 m long link chain fishing line attached to a 24.9 m footrope. The roller gear was 24.2 m long, constructed of 2 cm diameter galvanized wire rope, 36 cm-diameter rubber bobbins spaced 1.5 m apart and separated by a solid string of 10 cm-diameter rubber disks. At each end of the roller gear, a 5.9 m wire rope extension with 10 cm- and 20 cm-diameter rubber disks spanned the lower flying wing section. Trawls were made of 12.7 cm stretched-mesh polyethylene web with a 0.6 cm stretched-mesh nylon liner in the codend. Nets were

rigged with triple 54.9 m, 1.6 cm diameter galvanized wire rope dandyline. Steel V-doors (2.1 x 1.5 m) weighing approximately 567 kg each were used. For most of the tows, the fishing dimensions of the trawl were measured using a Scanmar<sup>1</sup> net measurement system. Preliminary inspection of the data revealed that the trawl nets fished by the *Vesteraalen* had a 14.6 m mean path width and a 7.0 m mean net height, while those fished aboard the *Dominator* had a 12.9 m mean path width and an 8.2 m mean net height.

Sea surface temperatures and temperature-depth profiles were obtained from most hauls with a net mounted data logger. Surface temperatures were also measured at most stations with a conventional bucket thermometer.

### **SURVEY DESIGN AND METHODS**

The triennial west coast bottom trawl survey was designed primarily as a method for assessing the abundance and distribution of a broad range of economically important groundfish species. We have modified the design of the survey periodically to collect more detailed information on specific species groups, while maintaining the primary multispecies objectives. In 1995 and 1998 we sampled stations in deeper water (367-500 m) to meet the current needs of resource managers for more complete data on slope-dwelling rockfish species such as darkblotched (*Sebastes crameri*), splitnose (*S. diploproa*), sharpchin (*S. zacentrus*), and redstriped rockfish (*S. proriger*).

The survey area extended from Point Conception (34°30'N) to SW Vancouver Island (49°30'N). The area was stratified by depth (55-183, 184-366, and 367-500 m) based on general distribution patterns of the major target species. Beginning at 34°34.5' N. latitude, 119 tracklines were drawn across the three depth strata spaced every 10 minutes of latitude. Over 600 stations were randomly located along these tracklines at the rate of one station per linear 7.4 km in the shallow stratum, and one station per linear 9.3 km in the middle and deep strata. At least one trawl station was assigned to each depth stratum along each trackline. The two vessels, when working simultaneously, fished alternate tracklines.

Fishing operations for both vessels were standardized. Captains were instructed to try to maintain a constant fishing depth,

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<sup>1</sup>Reference to trade names or commercial firms does not constitute U.S. government endorsement.

maintain a constant fishing speed of 3 knots, and to set the gear so that, upon first bottom contact, the trawl was as close to its fishing configuration as possible. Tows lasted 30 minutes between the time the net achieved a stable fishing configuration on bottom and the beginning of net retrieval. Electronic bottom contact sensors are hung from the footrope of the trawl to verify that the trawl is on bottom and to monitor the actual duration that the trawl remains in contact with the seabed. Catches were sorted, each species was weighed and counted, and a variety of biological data (age, length, weight, and maturity of individual specimens) were collected. Samples were also collected from several species for more detailed studies of their biology (age structures, tissue samples, stomach contents, etc).

## RESULTS

Successful trawl hauls were achieved at 527 of the 536 stations sampled (Figure 1). Fifty-nine stations were abandoned due to untrawlable bottom (Table 2) and we were unable to sample 13 stations on the northernmost two tracklines due to lack of time. Surface-to-bottom temperature profiles were collected by Richard Brancker Model XL200 microbathythermograph data loggers at 507 stations. Figure 2 presents sea surface and bottom temperatures by latitude.

We identified 195 fish species, representing 59 families, and numerous orders of invertebrates in catches throughout the survey. The types and counts of biological data collected as part of the RACE mission are summarized in Table 3. Age structures were collected from 20 groundfish or pelagic fish species. The structures will be examined and ages will be assigned for these specimens at several West Coast ageing laboratories.

Table 4 lists the dominant fish species caught by International North Pacific Fishery Commission (INPFC) area and depth stratum, ranked in order of catch per unit effort (CPUE, kg/ha). Figure 1 shows the INPFC area boundaries. Pacific hake was the dominant component of the catch in all INPFC areas except the Conception area. Shortbelly rockfish (*Sebastes jordani*) was predominant in that area. Other dominant catch components were splitnose rockfish (*S. diploproa*), Dover sole (*Microstomus pacificus*) and chilipepper (*S. goodei*) in the two southern areas; sablefish, Dover sole, and rex sole (*Glyptocephalus zachirus*) in the Eureka and Columbia areas; and spiny dogfish (*Squalus acanthias*), yellowtail rockfish (*Sebastes flavidus*), arrowtooth flounder (*Atheresthes stomias*), and sablefish in the Vancouver area.

Dominant species in the catches varied by depth stratum. Catches in the shallow depth stratum were dominated by Pacific hake in all areas except the Conception area, where shortbelly rockfish was the most abundant species. Catches in the middle depth stratum were dominated by splitnose and stripetail rockfish (*Sebastes saxicola*) in the Conception area; hake, splitnose, and chilipepper in the Monterey area; hake, Dover sole, and sablefish in the Eureka and Columbia areas; and yellowtail rockfish, Pacific ocean perch (*Sebastes alutus*), and arrowtooth flounder in the Vancouver area. The dominant catch components of the survey's deepest stratum included Dover sole and hake in all areas, as well as splitnose rockfish in the Conception area; rex sole in the Monterey area; sablefish in the Eureka and Columbia areas; and roughey rockfish (*S. aleutianus*), and Pacific ocean perch in the Vancouver area.

Figure 3 shows the unweighted size compositions for several commercially important groundfish species. These distributions suggest that recent year classes of several species, including Pacific hake, Pacific ocean perch, and chilipepper may be stronger than average.

#### ADJUNCT STUDIES

We dedicated a portion of the survey time to trawl gear research to better understand the catching dynamics of our sampling trawl. During the third leg of the cruise, scientists aboard the *Vesteraalen* conducted a seven-day trawl efficiency study examining escapement of fish under the footrope of the trawl. This study utilized two methods to quantify escapement: direct observations from underwater video cameras attached to the trawl and an auxiliary net mounted behind the footrope of the survey trawl to retain escaping fish. Researchers will compare the results of these two methods and evaluate whether artificial illumination required for the cameras affected the escapement estimates.

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Table 1.--Vessel itineraries and scientists participating during the 1998 NMFS triennial bottom trawl survey.

<b>F/V <i>Vesteraalen</i></b>			<b>F/V <i>Dominator</i></b>		
<b>Leg 1: 6/5 - 6/26</b> <u>SAN FRANCISCO - EUREKA</u>			<b>Leg 1: 6/5 - 6/26</b> <u>SAN FRANCISCO - EUREKA</u>		
Frank Shaw	Field Party Chief	AFSC	Bob Lauth	Field Party Chief	AFSC
Jay Orr	Fishery Biologist	AFSC	Mike MacEwan	Gear Specialist	AFSC
Russ Nelson	Fishery Biologist	AFSC	Mei-Sun Yang	Fishery Biologist	AFSC
Robin Harrison	Fishery Biologist	AFSC	Michael Martin	Fishery Biologist	AFSC
Bill Flerx	Fishery Biologist	AFSC	Carol Kimbrell	Fishery Biologist	SWFSC
Ron Erickson	Admin. Support	AFSC	Maegan Higgins	Student	OCC
<b>Leg 2: 6/26 - 7/17</b> <u>EUREKA - ASTORIA</u>			<b>Leg 2: 6/26 - 7/17</b> <u>EUREKA - ASTORIA</u>		
Michael Martin	Field Party Chief	AFSC	Mark Wilkins	Field Party Chief	AFSC
Jerry Hardman	Computer Spec.	AFSC	Bill Flerx	Fishery Biologist	AFSC
Larry Haaga	Fishery Biologist	AFSC	Jim Stark	Fishery Biologist	AFSC
Steve Kupillas	Fishery Biologist	ODFW	Geana Tyler	Fishery Tech.	AFSC
David Kois	Student	OCC	Carol Kimbrell	Fishery Biologist	SWFSC
Yong-Woo Lee	Student	OSU	Liz Chilton	Fishery Biologist	IPHC
<b>Leg 3: 7/17 - 8/8</b> <u>ASTORIA - SEATTLE</u>			<b>Leg 3: 7/17 - 8/8</b> <u>ASTORIA - SEATTLE</u>		
Ken Weinberg	Field Party Chief	AFSC	Mark Zimmermann	Field Party Chief	AFSC
Mike MacEwan	Gear Specialist	AFSC	Ron Payne	Fishery Tech.	AFSC
Eric Brown	Fishery Biologist	AFSC	Geana Tyler	Fishery Tech.	AFSC
Debbie Nebenzahl	Fishery Biologist	AFSC	Dan Kamikawa	Fishery Biologist	NWFSC
Delsa Anderl	Fishery Biologist	AFSC	Liz Chilton	Fishery Biologist	IPHC
Lyle Britt	Student	UW	Carol Kimbrell	Fishery Biologist	SWFSC
Dave Somerton	Fishery Biologist	AFSC			

Affiliations of the Scientists:

AFSC	- Alaska Fisheries Science Center, Seattle, Washington
IPHC	- International Pacific Halibut Commission, Seattle, Washington
NWFSC	- Northwest Fisheries Science Center, Seattle, Washington
OCC	- Orange County College, Costa Mesa, California
ODFW	- Oregon Department of Fish and Wildlife, Newport, Oregon
OSU	- Oregon State University, Corvallis, Oregon
SWFSC	- Southwest Fisheries Science Center, La Jolla, California
UW	- University of Washington, Seattle, Washington

Table 2.--Summary of sampling success at bottom trawl stations in each International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 1998 NMFS triennial bottom trawl survey.

INPFC Area		Shallow (55-183 m)	Middle (184-366 m)	Deep (367-500 m)	Total (55-500 m)
<b>Conception</b>	(south of 36°N lat)				
	Successful	16	12	18	46
	Unsuccessful	0	0	0	0
	Abandoned	0	0	1	1
<b>Monterey</b>	(36°-40°30'N lat)				
	Successful	77	23	25	125
	Unsuccessful	1	2	0	3
	Abandoned	3	6	3	12
<b>Eureka</b>	(40°30'-43°N lat)				
	Successful	38	16	14	68
	Unsuccessful	0	0	0	0
	Abandoned	1	0	2	3
<b>Columbia</b>	(43°-47°30'N lat)				
	Successful	118	40	28	186
	Unsuccessful	1	0	0	1
	Abandoned	6	4	9	19
<b>U.S. Vancouver</b>	(47°30'-Canada/U.S. border)				
	Successful	31	11	1	43
	Unsuccessful	1	0	1	2
	Abandoned	0	5	4	9
<b>Canadian Vancouver</b>	(north of Canada/U.S. border)				
	Successful	48	7	4	59
	Unsuccessful	3	0	0	3
	Abandoned	6	3	7	16

Table 3.--A summary of biological data and specimens collected during the 1998 West Coast triennial bottom trawl survey. Finrays were collected from lingcod for ageing and otoliths were collected from all other species. Abbreviations: length frequency (LF), age structure (AGE), individual specimen weight (WGT), and maturity (MAT).

SPECIES	LF	AGE	WGT	MAT	SPECIES	LF	AGE	WGT	MAT
American shad	705				Pacific hake	84,377	776	776	545
Arrowtooth flounder	5,593				Pacific halibut	438	328		
Aurora rockfish	3,076		140	86	Pacific herring	8,056		100	
Bank rockfish	17				Pacific ocean perch	2,831	560	560	211
Bering skate	16				Pacific pompano	251			
Big skate	3				Pacific sanddab	22,834		259	
Black rockfish	5				Pacific sardine	2,126	193	218	101
Blackgill rockfish	360	344	344	343	Pacific tomcod	1,261			
Blue rockfish	43				Petrale sole	2,858		12	
Bocaccio	446	146	146	130	Plainfin midshipman	195			
Brown cat shark	1				Pygmy rockfish	137			
Brown rockfish	1				Quillback rockfish	31			
Butter sole	21				Redbanded rockfish	226			
California halibut	15				Redstripe rockfish	1,460	280	280	71
Canary rockfish	772	378	380	242	Rex sole	37,673			
Chilipepper	4,158	441	441	439	Rock sole	687			
Chinook salmon	408		16		Rosethorn rockfish	719			
Chub mackerel	1,094	23	41		Rougheye rockfish	485		79	
Coho salmon	7				Sablefish	8,065	832	832	811
Copper rockfish	6				Sand sole	104			
Cowcod	20				Sharpchin rockfish	1,467	349	349	214
Curlfin sole	282				Shortbelly rockfish	2,036			
Darkblotched rockfish	3,398	470	470	469	Shortraker rockfish	14			
Dover sole	28,105	116	239		Shortspine thornyhead	10,681			
English sole	16,158				Silvergray rockfish	187	153	153	63
Filetail cat shark	55				Slender sole	8,566		19	
Flathead sole	1,284				Speckled rockfish	7			
Greenblotched rockfish	3				Spiny dogfish	1,088			
Greenspotted rockfish	171				Splitnose rockfish	12,046	350	350	350
Greenstriped rockfish	5,981				Starry flounder	24			
Halfbanded rockfish	502				Stripetail rockfish	7,174			
Hornyhead turbot	24				Vermilion rockfish	1			
Jack mackerel	1,041				Walleye pollock	235			
Kelp greenling	6				White croaker	1,797		130	
Lingcod	844	849	837	479	Widow rockfish	965			
Longnose skate	49				Yelloweye rockfish	43	43	43	15
Longspine thornyhead	2,423				Yellowmouth rockfish	16	16	16	13
Northern anchovy	1,169				Yellowtail rockfish	4,323	1,581	1,611	1,110
Pacific cod	317								



Table 4.--Mean CPUE (kg/ha) for the 15 most abundant groundfish species by International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 1998 triennial groundfish survey.

CONCEPTION AREA 55 - 183 m		CONCEPTION AREA 184 - 366 m		CONCEPTION AREA 367 - 500 m		CONCEPTION AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Shortbelly rockfish	53.1	Splitnose rockfish	20.4	Pacific hake	32.7	Shortbelly rockfish	18.6
Jack mackerel	15.4	Stripetail rockfish	17.1	Splitnose rockfish	23.0	Pacific hake	17.4
Pacific sanddab	8.6	Pacific hake	16.1	Dover sole	22.6	Splitnose rockfish	14.4
Chilipepper	5.4	Rex sole	5.5	Rex sole	7.9	Dover sole	9.5
White croaker	4.1	Dover sole	2.4	Aurora rockfish	4.8	Jack mackerel	5.4
Pacific herring	2.0	Chilipepper	1.2	Sablefish	2.7	Stripetail rockfish	4.9
Spiny dogfish	1.3	Slender sole	0.9	Longspine thornyhead	2.3	Rex sole	4.6
Stripetail rockfish	1.1	Shortbelly rockfish	0.3	Blackgill rockfish	2.0	Pacific sanddab	3.0
Pacific hake	1.0	Spiny dogfish	0.2	Longnose skate	1.5	Chilipepper	2.2
Pacific argentine	1.0	Big skate	0.2	Bigfin eelpout	1.1	Aurora rockfish	1.9
English sole	0.8	Sablefish	0.2	Shortfin eelpout	0.9	White croaker	1.4
Pacific angel shark	0.8	Longnose skate	0.2	Shortspine thornyhead	0.7	Sablefish	1.1
Halfbanded rockfish	0.8	Bigfin eelpout	0.2	Filetail cat shark	0.5	Longspine thornyhead	0.9
Petrale sole	0.6	Spotted ratfish	0.2	Spotted ratfish	0.4	Blackgill rockfish	0.8
Pacific pompano	0.5	Bering skate	0.2	Pacific electric ray	0.3	Pacific herring	0.7
Number of Hauls	16	Number of Hauls	12	Number of Hauls	18	Number of Hauls	46

MONTEREY AREA 55 - 183 m		MONTEREY AREA 184 - 366 m		MONTEREY AREA 367 - 500 m		MONTEREY AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Pacific hake	21.5	Pacific hake	102.3	Dover sole	45.8	Pacific hake	36.6
Pacific herring	14.4	Splitnose rockfish	46.7	Pacific hake	22.9	Dover sole	12.9
Chilipepper	12.3	Chilipepper	28.5	Rex sole	17.9	Chilipepper	12.8
Pacific sanddab	8.0	Dover sole	18.5	Sablefish	10.0	Splitnose rockfish	10.1
White croaker	7.6	Spiny dogfish	16.8	Splitnose rockfish	7.4	Pacific herring	8.9
Jack mackerel	7.3	Shortbelly rockfish	16.6	Aurora rockfish	4.2	Spiny dogfish	6.8
Pacific sardine	5.8	Stripetail rockfish	15.4	Spiny dogfish	3.5	Rex sole	6.0
Spiny dogfish	4.9	Rex sole	9.2	Shortspine thornyhead	2.8	Pacific sanddab	5.0
Yellowtail rockfish	4.4	Widow rockfish	4.6	Bigfin eelpout	2.7	White croaker	4.7
Chub mackerel	3.8	Sablefish	4.0	Spotted ratfish	2.6	Jack mackerel	4.6
Northern anchovy	2.8	English sole	2.0	Longnose skate	1.5	Stripetail rockfish	4.4
Stripetail rockfish	2.6	Spotted ratfish	1.6	Brown cat shark	1.4	Pacific sardine	3.6
English sole	2.1	Longnose skate	1.1	Blackgill rockfish	1.3	Shortbelly rockfish	3.3
Chinook salmon	1.8	Sharpchin rockfish	0.8	Longspine thornyhead	0.6	Sablefish	2.8
Rex sole	1.1	Bigfin eelpout	0.7	Filetail cat shark	0.4	Yellowtail rockfish	2.7
Number of Hauls	77	Number of Hauls	23	Number of Hauls	25	Number of Hauls	125

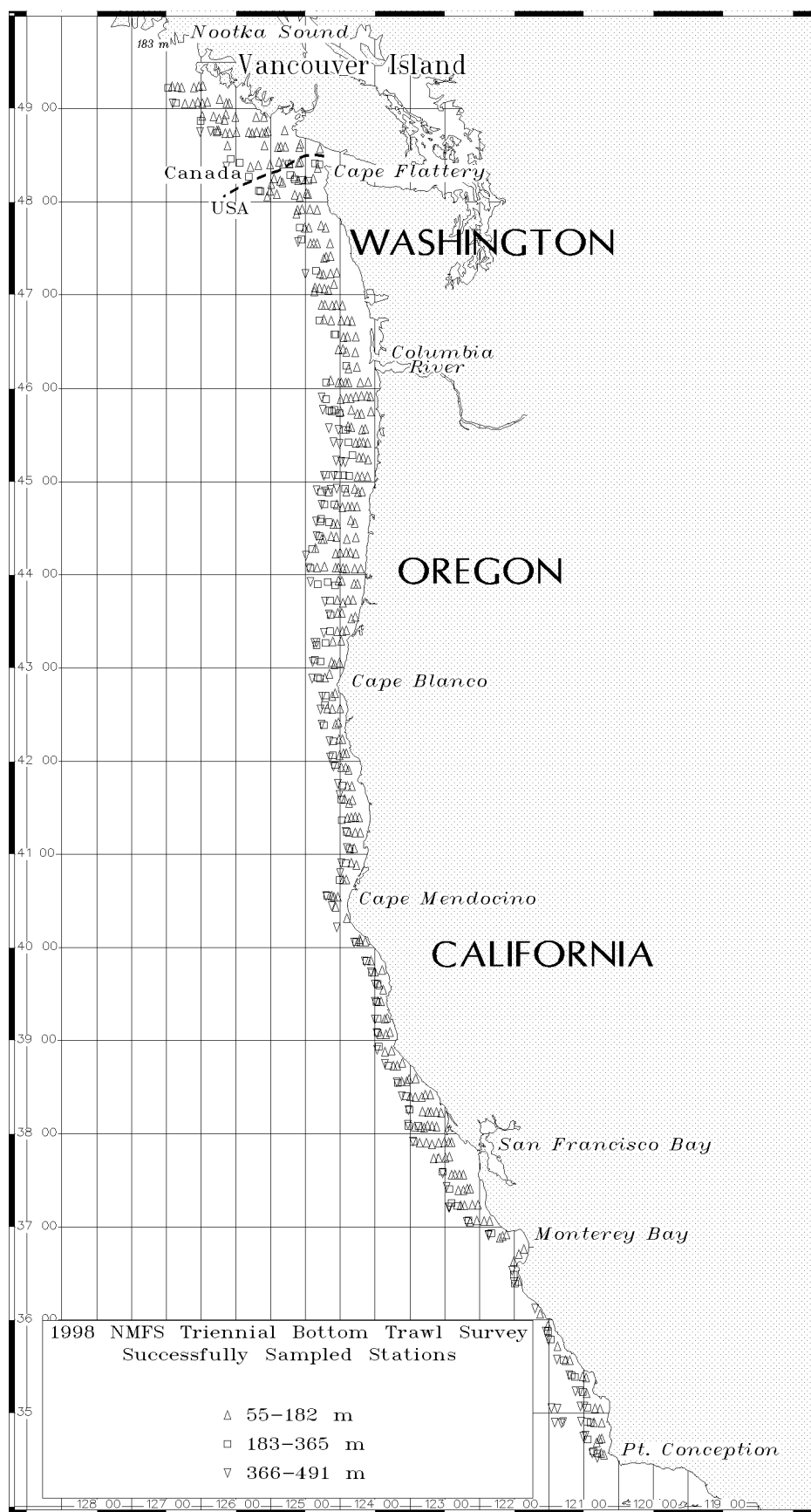
EUREKA AREA 55 - 183 m		EUREKA AREA 184 - 366 m		EUREKA AREA 367 - 500 m		EUREKA AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Pacific hake	228.0	Pacific hake	58.6	Dover sole	33.1	Pacific hake	144.8
English sole	5.0	Dover sole	25.2	Sablefish	28.4	Dover sole	15.4
Pacific sanddab	4.8	Sablefish	14.2	Pacific hake	17.1	Sablefish	9.2
Dover sole	4.7	Rex sole	12.5	Rex sole	13.5	Rex sole	7.9
Rex sole	3.9	Spiny dogfish	10.0	Shortfin eelpout	4.4	Spiny dogfish	5.1
Spiny dogfish	3.8	Splitnose rockfish	5.4	Brown cat shark	4.3	English sole	3.2
Pacific herring	1.9	Stripetail rockfish	4.3	Shortspine thornyhead	4.0	Pacific sanddab	2.7
Petrale sole	1.3	Longnose skate	2.2	Aurora rockfish	2.7	Stripetail rockfish	1.6
Stripetail rockfish	1.1	Chilipepper	2.2	Spiny dogfish	2.7	Splitnose rockfish	1.4
Pacific halibut	1.1	Darkblotched rockfish	2.0	Bigfin eelpout	1.4	Longnose skate	1.1
Big skate	1.1	English sole	1.9	Arrowtooth flounder	1.4	Shortspine thornyhead	1.1
Yellowtail rockfish	0.9	Bigfin eelpout	1.3	Longnose skate	0.7	Pacific herring	1.0
Longnose skate	0.8	Spotted ratfish	1.2	Longspine thornyhead	0.3	Shortfin eelpout	1.0
Slender sole	0.5	Arrowtooth flounder	1.0	Spotted ratfish	0.2	Brown cat shark	1.0
Blackbelly eelpout	0.5	Shortspine thornyhead	1.0	Bering skate	0.2	Pacific halibut	0.8
Number of Hauls	38	Number of Hauls	16	Number of Hauls	14	Number of Hauls	68

Table 4 (cont.)

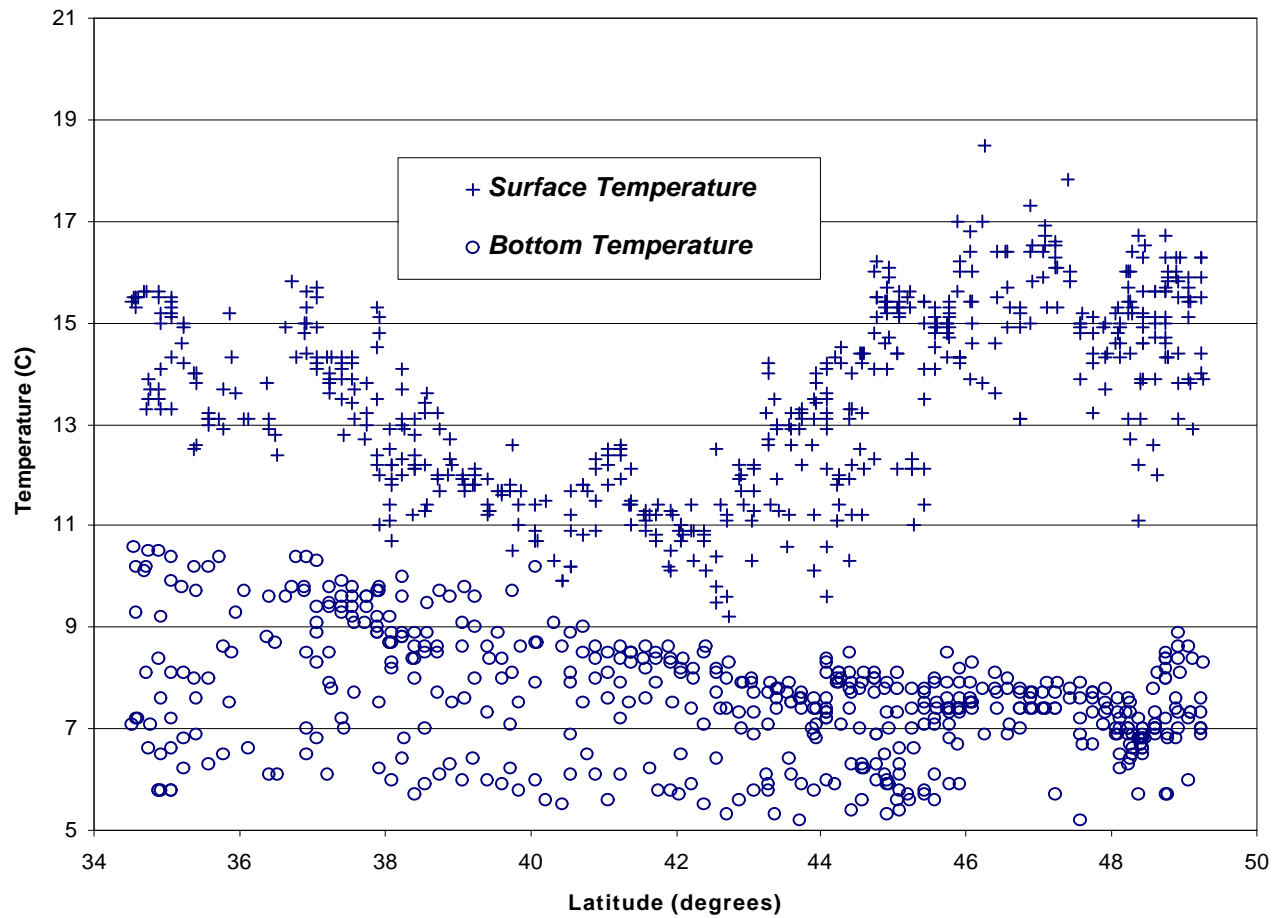
COLUMBIA AREA 55 - 183 m		COLUMBIA AREA 184 - 366 m		COLUMBIA AREA 367 - 500 m		COLUMBIA AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Pacific hake	131.3	Pacific hake	84.1	Pacific hake	20.0	Pacific hake	104.4
Pacific sanddab	9.2	Sablefish	17.4	Dover sole	15.4	Sablefish	10.5
Sablefish	7.2	Dover sole	11.5	Sablefish	14.8	Dover sole	8.3
English sole	5.9	Splitnose rockfish	10.1	Shortspine thornyhead	7.9	Rex sole	6.3
Rex sole	5.6	Rex sole	9.7	Rex sole	4.3	Pacific sanddab	5.8
Dover sole	5.5	Sharpchin rockfish	7.1	Arrowtooth flounder	1.1	English sole	3.9
Spiny dogfish	5.0	Pacific ocean perch	6.3	Brown cat shark	0.9	Spiny dogfish	3.5
Pacific herring	4.9	Shortspine thornyhead	4.5	Aurora rockfish	0.8	Pacific herring	3.1
Yellowtail rockfish	2.6	Arrowtooth flounder	3.7	Longspine thornyhead	0.8	Shortspine thornyhead	2.2
American shad	2.4	Pacific halibut	3.6	Pacific ocean perch	0.8	Splitnose rockfish	2.2
Pacific halibut	2.0	Lingcod	3.3	Longnose skate	0.8	Yellowtail rockfish	2.2
Arrowtooth flounder	1.7	Yellowtail rockfish	2.4	Bigfin eelpout	0.7	Arrowtooth flounder	2.1
Greenstriped rockfish	1.5	Darkblotched rockfish	2.3	Spiny dogfish	0.7	Pacific halibut	2.0
Chub mackerel	1.5	Stripetail rockfish	2.2	Rougheye rockfish	0.5	American shad	1.6
Big skate	1.0	Spiny dogfish	1.2	Shortfin eelpout	0.4	Sharpchin rockfish	1.5
Number of Hauls	118	Number of Hauls	40	Number of Hauls	28	Number of Hauls	186

U.S. VANCOUVER AREA		U.S. VANCOUVER AREA		U.S. VANCOUVER AREA		U.S. VANCOUVER AREA		
55 - 183 m		184 - 366 m		367 - 500 m		55 - 500 m		
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	
Pacific hake	166.8	Pacific hake	20.6	Pacific hake	4.6	Pacific hake	125.6	
Spiny dogfish	44.1	Pacific ocean perch	20.1	Dover sole	4.6	Spiny dogfish	33.5	
Yellowtail rockfish	42.4	Dover sole	17.9	Longspine thornyhead	3.0	Yellowtail rockfish	32.7	
Arrowtooth flounder	21.6	Arrowtooth flounder	12.2	Shortspine thornyhead	2.7	Arrowtooth flounder	18.7	
Pacific sanddab	8.4	Sablefish	12.1	Sablefish	1.2	Dover sole	7.9	
Pacific halibut	7.1	Widow rockfish	8.9	Pacific flatnose	0.6	Sablefish	6.8	
English sole	5.1	Spotted ratfish	8.8	Rex sole	0.4	Pacific sanddab	6.1	
Sablefish	5.0	Yellowtail rockfish	8.4	Spotted ratfish	0.3	Pacific halibut	5.5	
Dover sole	4.5	Spiny dogfish	6.6	Shortfin eelpout	0.2	Spotted ratfish	5.4	
Spotted ratfish	4.4	Rex sole	6.1	Brown cat shark	0.2	Pacific ocean perch	5.2	
Redstripe rockfish	3.8	Longnose skate	2.5	Deepsea sole	0.2	Widow rockfish	4.1	
Widow rockfish	2.5	Shortspine thornyhead	2.0	Aleutian skate	0.2	English sole	3.9	
Longnose skate	2.4	Darkblotched rockfish	1.5	Myctophids	Trace	Rex sole	3.2	
Greenstriped rockfish	2.4	Pacific halibut	1.4	Pacific viperfish	Trace	Redstripe rockfish	2.8	
Rex sole	2.3	Pacific cod	1.4	Longfin dragonfish	Trace	Longnose skate	2.4	
Number of Hauls		31	Number of Hauls		11	Number of Hauls		43

CANADIAN VANCOUVER AREA		CANADIAN VANCOUVER AREA		CANADIAN VANCOUVER AREA		CANADIAN VANCOUVER AREA		
55 - 183 m		184 - 366 m		367 - 500 m		55 - 500 m		
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	
Pacific hake	48.3	Yellowtail rockfish	92.5	Rougheye rockfish	27.0	Pacific hake	40.1	
Spiny dogfish	46.3	Pacific ocean perch	46.4	Pacific ocean perch	16.1	Spiny dogfish	37.8	
Arrowtooth flounder	17.8	Arrowtooth flounder	37.6	Dover sole	13.8	Arrowtooth flounder	19.8	
Sablefish	13.2	Redstripe rockfish	21.8	Arrowtooth flounder	11.7	Yellowtail rockfish	19.1	
Pacific herring	12.4	Sharpchin rockfish	15.8	Shortspine thornyhead	5.8	Sablefish	12.8	
Yellowtail rockfish	9.9	Sablefish	15.3	Rex sole	5.0	Pacific herring	10.1	
Dover sole	9.1	Widow rockfish	12.7	Pacific hake	4.9	Dover sole	9.6	
Rex sole	5.9	Dover sole	10.8	Longnose skate	4.0	Pacific ocean perch	7.5	
Pacific halibut	4.8	Greenstriped rockfish	10.3	Sablefish	2.4	Rex sole	6.0	
Lingcod	4.0	Silvergray rockfish	8.0	Pacific halibut	0.6	Redstripe rockfish	4.4	
English sole	3.9	Rex sole	7.5	Bigfin eelpout	0.3	Pacific halibut	4.3	
Pacific sanddab	3.9	Canary rockfish	6.2	Petrable sole	0.3	Lingcod	3.4	
Redstripe rockfish	2.2	Pacific hake	4.1	Spotted ratfish	0.2	English sole	3.3	
Canary rockfish	1.7	Pacific halibut	3.1	Darkblotched rockfish	0.2	Pacific sanddab	3.2	
Flathead sole	1.4	Darkblotched rockfish	2.5	Spiny dogfish	0.2	Greenstriped rockfish	2.2	
Number of Hauls		48	Number of Hauls	7	Number of Hauls	4	Number of Hauls	59



**Figure 1.**--Stations sampled successfully during the 1998 NMFS triennial bottom trawl survey.



**Figure 2.--** Trends in water temperatures by latitude measured during the 1998 National Marine Fisheries Service triennial West Coast bottom trawl survey.

Figure 3.-- Unweighted size compositions for selected groundfish species from results of the 1998 NMFS triennial West Coast bottom trawl survey of groundfish resources.

